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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/699,466 10/31/00 YAMAZAKI

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EXAMINER

022204 MMC2/0405
NIXON PEABODY, LLP
8180 GREENSBORO DRIVE
SUITE 800
MCLEAN VA 22102

ART UNIT PAPER NUMBER

2813
DATE MAILED:

04/05/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/699,466

Applicant(s)

YAMAZAKI ET AL.

Examiner

Asok K. Sarkar

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 October 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☒ Certified copies of the priority documents have been received in Application No. 08/784,290.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- 15) ☒ Notice of References Cited (PTO-892)
- 16) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 18) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 19) ☐ Notice of Informal Patent Application (PTO-152)
- 20) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Biegesen et al., US 4,330,363 in view of Ham et al., US 3,890,632.

Biegesen et al. teaches a method of manufacturing a semiconductor device where they form a crystalline semiconductor film on an insulating surface in Column 1, lines 37 - 40 in the form of a semiconductor island with respect to Fig. 1 in Column 4, lines 14 - 16 and irradiating a laser light to the semiconductor island in column 4, lines 21 - 22.

Biegesen et al. does not expressly teach forming the islands with a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface.

Ham et al. teaches a method of manufacturing a semiconductor device where they form a semiconductor island 14 with reference to Fig. 1 and 2 in column 1, lines 63 - 65 with a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface in column 3, lines 17 - 18.

Therefore, given the substantial teaching of Biegesen et al. in view of Ham et al., it would have been obvious to one with ordinary skill in the art at the time of the

invention to manufacture the semiconductor device with semiconductor islands having a tapered shape and having an angle within a range of 20° to 50° between the side and underlying surface in order to enhance stability of the transistors.

3. Claims 4, 5, 7, 8, 10 - 12, 14 - 16, 18 - 21, 23 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Biegesen et al., US 4,330,363 and Funai et al., US 5,550,070 in view of Ham et al., US 3,890,632.

Regarding claims 4, 5, 8, 12, 16 and 21, Biegesen et al. teaches a method of manufacturing a semiconductor device where they form a polycrystalline semiconductor film on an insulating surface in Column 1, lines 37 - 40 in the form of a amorphous semiconductor island with respect to Fig. 1 in Column 4, lines 14 - 16 and irradiating a laser light to the semiconductor island in column 4, lines 21 - 22.

Funai et al. teaches a method of crystallizing the semiconductor film by heating at a temperature of 550°C in column 6, line 39 to 650°C or higher in column 2, line 56.

Biegesen et al. and Funai et al. do not expressly teach forming the islands with a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface.

Ham et al. teaches a method of manufacturing a semiconductor device where they form a semiconductor island 14 with reference to Fig. 1 and 2 in column 1, lines 63 - 65 with a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface in column 3, lines 17 - 18.

Therefore, given the substantial teaching of Biegesen et al. and Funai et al., in view of Ham et al., it would have been obvious to one with ordinary skill in the art at the

time of the invention to manufacture the semiconductor device with crystallized semiconductor islands produced by heating, form a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface in order to enhance stability of the transistors.

Regarding claims 7, 10, 11, 14, 15, 18 – 20, 23 and 25, Biegesen et al. teaches a method of manufacturing a semiconductor device where they form a polycrystalline semiconductor film on an insulating surface in Column 1, lines 37 - 40 in the form of a amorphous semiconductor island with respect to Fig. 1 in Column 4, lines 14 – 16 and irradiating a laser light to the semiconductor island in column 4, lines 21 - 22.

Funai et al. teaches a method of crystallizing the semiconductor film by providing a crystallization promoting material such as Fe, Co, Ni, Pd, Pt, Cu and Au in column 5, lines 24 – 25, heating at a first temperature of 550°C in column 6, line 39 to 650°C or higher in column 2, line 56 to crystallize the semiconductor film, forming a silicon oxide film on the surface of the semiconductor film by a second heating at a higher temperature than the second heating in column 9, lines 16 – 25 with respect to Fig. 7 and reducing the crystallization promoting material by removing the oxide in column 4, lines 35 – 40. The oxidation temperature of 650°C is higher than the crystallization temperature of $550 - 580^{\circ}\text{C}$ in column 8, line 42.

Biegesen et al. and Funai et al. do not expressly teach forming the islands with a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface.

Ham et al. teaches a method of manufacturing a semiconductor device where they form a semiconductor island 14 with reference to Fig. 1 and 2 in column 1, lines 63 - 65 with a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface in column 3, lines 17 - 18.

Therefore, given the substantial teaching of Biegensen et al. and Funai et al., in view of Ham et al., it would have been obvious to one with ordinary skill in the art at the time of the invention to manufacture the semiconductor device with crystallized semiconductor islands produced by heating, form a tapered shape having an angle within a range of 20° to 50° between the side and underlying surface in order to enhance stability of the transistors and then oxidize the surface by a second heating at a higher temperature than the crystallization temperature.

4. Claims 3, 6, 9, 13, 17 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Biegensen et al., US 4,330,363 and Funai et al., US 5,550,070 in view of Ham et al., US 3,890,632 as applied to claims 1, 4, 7, 11, 15 and 20 above, and further in view of Boyan et al., US 4,466,073.

Biegensen et al. (and Funai et al., in view of Ham et al.) teaches isotropic wet etching in column 3, lines 10 - 16, but fails to use an isotropic dry etching method.

Boyan et al. teaches a method of dry isotropic etching in column 1, lines 11 - 20 in order to minimize absolute alignment accuracy.

Therefore, given the substantial teaching of Biegensen et al. in view of Ham et al. and further in view of Boyan et al., it would have been obvious to one with ordinary skill

in the art at the time of the invention to manufacture the semiconductor device with semiconductor islands having a tapered shape by isotropic dry etching.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biegesen et al., US 4,330,363 Funai et al., US 5,550,070 in view of Ham et al., US 3,890,632 and Boyan et al., US 4,466,073 as applied to claim 20 above, and further in view of Gandhi, VLSI Fabrication Principles, John Wiley and Sons, p. 388, 1983.

Biegesen et al. and Funai et al. in view of Ham et al. and Boyan et al. do not expressly teach second heating performed in an atmosphere containing halogen gas.

Gandhi teaches that addition of halogenic species during dry oxidation improves electronic properties of the oxide in the chapter of thermal oxidation of silicon in page 388, paragraph 7.1.6.

Therefore, given the substantial teaching of Biegesen et al. and Funai et al. in view of Ham et al. and Boyan et al. and further in view of Gandhi, it would have been obvious to one with ordinary skill in the art at the time of the invention to manufacture the semiconductor device by heating the semiconductor in an atmosphere containing halogen gas.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double

patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1, 2, 4, 7, 11, 15 and 20 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 5 and 6 of U.S. Patent No. 6,180,439 B1. All limitations of these claims such as forming semiconductor film with crystallization promoting materials, crystallizing the film by first heating, patterning the film to an island/mesa shape, laser irradiating the island, reducing crystallization promoting materials by forming a silicon oxide by a second heating are disclosed by claims 5 and 6 of U.S. Patent No. 6,180,439 B1.

7. Claims 14, 18 and 23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 5 of U.S. Patent No. 6,180,439 B1. Claim 5 discloses that the second heating is performed at a higher temperature than the first heating.

8. Claims 10, 19 and 25 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 24 of U.S. Patent No. 6,180,439 B1. Claim 24 discloses the crystallization promoting materials of the instant claims.

9. Claim 24 is rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 25 of U.S. Patent No. 6,180,439 B1. Claim 25 discloses that the second heating is performed in an oxidizing atmosphere of halogen gas.

10. Claims 3, 6, 9, 13, 17 and 22 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 4 and 5 of U.S. Patent No. 6,180,439 B1 in view of Boyan et al., US 4,466,073.

U.S. Patent No. 6,180,439 B1 fails to disclose patterning by isotropic dry etching method.

But, as explained earlier, Boyan et al. teaches a method of dry isotropic etching in column 1, lines 11 – 20 in order to minimize absolute alignment accuracy.

Therefore, given the substantial teaching of claims 4 and 5 of U.S. Patent No. 6,180,439 B1 in view of Boyan et al., it would have been obvious to one with ordinary skill in the art at the time of the invention to manufacture the semiconductor device with semiconductor islands having a tapered shape by isotropic dry etching.

11. Claims 5, 8, 12, 16 and 21 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 4 and 5 of U.S. Patent No. 6,180,439 B1 in view of Funai et al., US 5,550,070.

U.S. Patent No. 6,180,439 B1 fails to disclose heating at a temperature of 550 to 750°C.

Funai et al. teaches a method of crystallizing the semiconductor film by heating at a temperature of 550°C in column 6, line 39 to 650°C or higher in column 2, line 56.

Therefore, given the substantial teaching of claims 4 and 5 of U.S. Patent No. 6,180,439 B1 in view of Funai et al., it would have been obvious to one with ordinary skill in the art at the time of the invention to manufacture the semiconductor device with

semiconductor islands by heating at a temperature of 550 to 750°C to crystallize the semiconductor.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Ipri, A., US 4,597,160 and Miyasaka et al., US 5,504,019 disclose method for crystallizing deposited silicon layer. Nakata et al., US 4,546,376 teaches tapered shaped semiconductor island.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is (703) 308-2521. The examiner can normally be reached on 8:00 AM - 5:00PM ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers can be reached on (703) 308-2417. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-4918.

Application/Control Number: 09/699,466

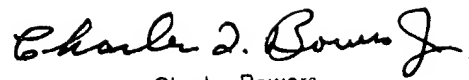
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April 3, 2001

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